

Do pianists play with their teeth?

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The aim of this study was to find out whether the masticatory and postural muscles are used by pianists during their music performances. The study also aimed to ascertain whether the complex neuromuscular activity involved in the act of playing the piano also encourages hyperactivity in terms of the masticatory muscles. The bio-electric potentials of the masticatory and postural muscles of 20 pianists were recorded by surface electromyography (EMG). The EMG recordings obtained regarding the temporal and masticatory muscles are much higher than those recorded when in the resting position. These recordings, which are not the same as those obtained, for example, when the individuals are chewing hard food such as a carrot, are nonetheless indicative of daily parafunctional activity in musicians who often study for as much as seven hours per day.

Keywords: pianists; electromyography; muscular hyperactivity; masticatory muscles; postural muscles

Music performance is based on the knowledge musicians acquire through a great deal of deliberate practice to obtain high levels of skills (Ericsson *et al.* 1993, Hallam 1997). Consequently, the incidence of focal dystonia, for example, may be as high as one in 200 professional musicians (Altenmüller 2000). Research has shown the musculoskeletal system to be the most frequently involved area of impairment (Morse *et al.* 2000). Orofacial problems may also be included as result of the musicians' professional activity. Orthodontic problems, focal dystonia, herpes labialis, dry mouth, and temporomandibular joint disorders (TMD) have been identified especially among wind and string players, as well as vocalists. These problems may result from the impact of the selected instrument on the orofacial structures of the musician (Raney

2006) or from an inadequate dental treatment and increase with stress. In all cases, it may be detrimental to the musicians' careers.

Pianists are among the highest in number of music college students in Portugal, both in classical and jazz degree courses. Research on piano related injuries is mainly focused on the upper limbs, namely the hand adaptation to the keyboard, hand pain, focal hand dystonia, finger joints or tendon, and arm overuse related problems (Shields and Dockrell 2000, Sakai 2008). Yet, little has been written about their orofacial activity. Given the duration and intensity of the daily practice these pianists might undertake (as much as seven hours per day), they may well develop a parafunctional activity, especially in the masticatory and postural muscles. It is extremely important to monitor such activity so that muscular hyperactivity does not interfere in maintaining a functional equilibrium of the cranio-cervico-mandibular complex. Hence, the aim of the present study was to determine whether the masticatory muscles, whose main functions are chewing, swallowing, and speaking, are used by pianists during their music performances and so to ascertain whether the complex neuromuscular activity involved in the act of playing the piano also encourages hyperactivity in terms of the masticatory and postural muscles. Since we had both classical and jazz pianists in our sample, an additional aim was to ascertain whether different styles have a different effect on the masticatory and postural muscles.

METHOD

Participants

The experiment was conducted with 20 participants, ranging from 18 to 27 years old with classical and jazz piano training. In this article, we present the most significant cases.

Materials

The electromyographic (EMG) activity was recorded using the Bio EMG 2 electromyograph with eight channels (Bioresearch Associates Inc., Milwaukee, Wisconsin, USA).

Procedure

An alcohol pad was wiped in the area where the sensors were to be placed and a conductive gel was placed on a 9 mm diameter disposable silver/silver-chloride bipolar surface electrodes (Duo-Trode, Myotronics Inc., Seattle, Washington, USA), before their attachment to the skin. These bipolar surface



Figure 1. Pianists performing a jazz (left) and a classical piece (right).

electrodes were located on the muscular bellies of the anterior temporalis, masseter, digastric, and trapezius muscles of both sides (right and left), and parallel to the muscle fibers.

The electromyographic activity was recorded during the following procedures: (1) at rest, (2) maximum voluntary clenching in the intercuspal position, (3) maximum voluntary opening, (4) playing piano, and (5) eating a cake. Subjects played a piece of their choice in a classical and jazz style (see Figure 1). A resting period of one minute between recordings was allowed to avoid muscular fatigue.

RESULTS

The head posture adopted by piano players during their performance gave different patterns of EMG activity in the masticatory and postural muscles. The visual system used in this study played an important role in the perception that there are variations in seated positions between classical piano and jazz players, with direct implications on the cranio-cervico-mandibular complex.

Likewise, it is possible to verify an adoption of an anterior head position on jazz players, with a tendency of most of these subjects to maintain a jaw position by using the anterior temporal more than the masseter muscles. In classical players, there were higher values on the EMG activity of the masseter muscles compared with the jazz players. A contributing factor can be that jazz players are used to improvising during their performance while classical players have a prolonged and strained stress placed on the masticatory muscles, specifically the masseter muscle. For the particular case of classical pianists, we were able to compare the activity of a mandible elevator muscle

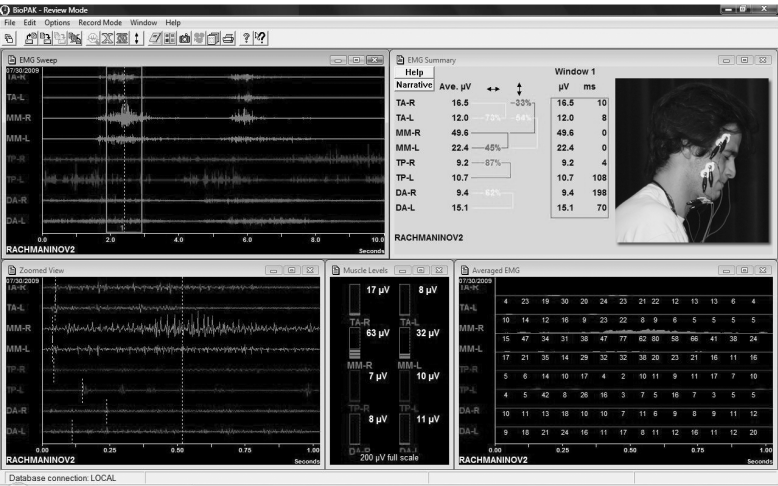


Figure 2. Pianist with high electromyographic activity of the masseter muscle.

(masseter) during one of its main functions: eating. When eating a cake, the bioelectrical potential of the masseter muscles reached 15-18 μV , while playing for example the C minor Rachmaninoff concerto, the masseter muscle can reach values of 49.6 μV .

The findings of this study illustrate that pianists may feel persistent neck and orofacial pain due to the large number of hours of piano exposure, highlighting the physical demands as well as the psychosocial factors involved in such a demanding profession. Understanding what kind of muscles are being used in the cranio-cervico-mandibular complex during the performance of a pianist is of vital importance as it can help in the correct diagnosis of a concrete problem originated by repetitive movements.

The aim of the study was to understand how the orofacial muscles behave during voluntary exercise such as piano playing, where the activity of some muscles—like masseter, digastrics, or the anterior temporal—should have minimum activity given that their key activity should occur mainly during mastication, speech, and swallowing. In this particular case it was not a question of being able to evaluate if the fatigue of these muscles could restrict the pianist to the point of no longer being able to performing the task: piano playing. An overuse of these muscles may have a direct impact on the pianists' quality of life when performing their maximal voluntary performance of these orofacial muscles during normal tasks like eating.

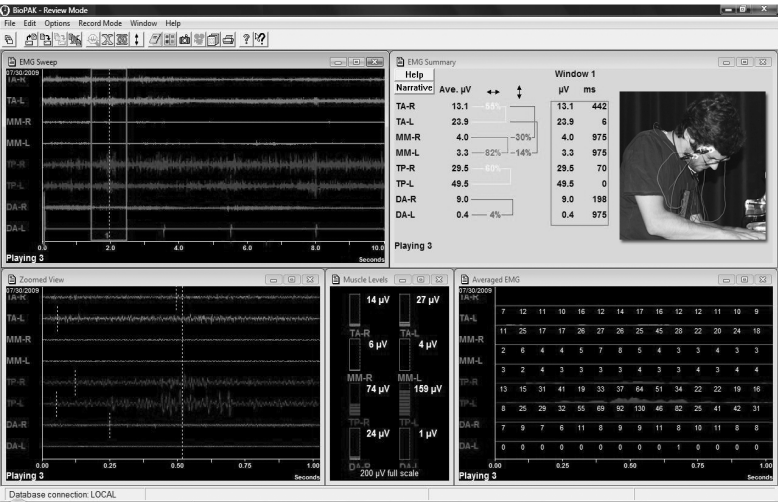


Figure 3. Pianist with high electromyographic activity of the trapezius muscle.

In time, these kinds of restrictions can induce pain that can be related to certain movements or occur at any time of the day. This special attention toward performers' health issues and specific needs will provide a working diagnosis, allowing health care professionals to focus their examination rather than conducting a series of tests that are usually time consuming.

Having piano players, teachers, and performing arts medicine professionals conscious of what is actually happening to the orofacial region while playing piano will encourage the daily supervision of any parafunctional habit like clenching their teeth during performance.

DISCUSSION

Do pianists really play with their teeth? The essential point is "yes," some pianists do in fact play with their teeth, since they have an activity of their masseter and anterior temporal muscles that acts as an elevator of the mandible, forcing the mandible teeth to contact the maxillary teeth. So here piano players, during their daily performance, have parafunctional habits inducing hyperactivity of some of the orofacial muscles that very often is associated when an individual is concentrated on a particular task or when anxiety levels rise.

Further studies would benefit from a multimodal approach in which this method would run in parallel with high resolution sound recording and motion capture.

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